CLAIMS

What is claimed is:

1. A method for determining properties of a conductive film, comprising:
selecting a plurality of probe locations proximate a periphery of the conductive film;
measuring electrical resistance along a plurality of measurement lines, the plurality of measurement lines comprising line segments extending between each probe location and at least some other probe locations in the plurality of probe locations;
analyzing the measured electrical resistances to determine a lumped parameter resistance model along the plurality of measurement lines; and
estimating an electrical resistivity value at a selected location on the conductive film encompassed by measurement lines extending between at least three of the plurality of probe locations.

2. The method of claim 1, further comprising extrapolating the electrical resistivity value at the selected location to another physical property correlative with the electrical resistivity value.

3. The method of claim 2, wherein the other physical property is selected from the group consisting of a thermal property, strain, photosensitivity, and physical anomalies.

4. The method of claim 1, further comprising initiating the measuring, analyzing and estimating in response to an event.

5. The method of claim 1, further comprising repeating the estimating for a plurality of selected locations to develop a resistivity profile across the conductive film.

6. The method of claim 5, further comprising extrapolating the resistivity profile to a profile of another physical property correlative with the resistivity profile.

7. The method of claim 6, wherein the another physical property is selected from the group consisting of a thermal property, strain, photosensitivity, and physical anomalies.

8. The method of claim 1, further comprising repeating the measuring, analyzing, and estimating for a plurality of selected locations and at a plurality of times to develop a time varying resistivity profile across the conductive film.

9. The method of claim 8, further comprising extrapolating the time varying resistivity profile to a time varying profile of another physical property correlative with the time varying resistivity profile.

10. The method of claim 9, wherein the another physical property is selected from the group consisting of a thermal property, strain, photosensitivity, and physical anomalies.

11. The method of claim 1, wherein the estimating further comprises performing a weighted average of the lumped parameter resistance model associated with each of three measurement lines defining a triangle encompassing the selected location to determine the electrical resistivity value, wherein the weighted average is related to orthogonal distances from the selected location to each of the three measurement lines defining the triangle.

12. The method of claim 1, wherein the estimating further comprises:

performing a weighted average of the lumped parameter resistance model associated with each of three measurement lines defining a triangle encompassing the selected location to determine a first electrical resistivity value, wherein the weighted average is related to orthogonal distances from the selected location to each of the three measurement lines defining the triangle;

performing a at least one additional weighted average of the lumped parameter resistance model associated with each of three other measurement lines, at least two of which are different than measurement lines of the three measurement lines, defining an additional triangle encompassing the selected location to determine at least one additional electrical resistivity value, wherein the weighted average is related to orthogonal distances from the selected location to each of the three other measurement lines defining the additional triangle; and

combining the first electrical resistivity value and the at least one additional electrical resistivity value to determine the electrical resistivity value.

13. The method of claim 1, further comprising removing at least one measured electrical resistance from consideration in the analyzing.

14. The method of claim 13, further comprising estimating when the at least one measured electrical resistance to be removed is anomalous.

15. The method of claim 1, wherein the conductive film is applied on a surface of a structure.

16. The method of claim 15, wherein the surface of the structure comprises a nonplanar surface in three dimensions.

17. A method for determining surface properties of a structure, comprising:
applying an electrically conductive film to a surface of the structure;
selecting a plurality of probe locations proximate a periphery of the conductive film;
measuring electrical resistance along a plurality of measurement lines, the plurality of measurement lines comprising line segments extending between each probe location and at least some other probe locations in the plurality of probe locations;
analyzing the measured electrical resistances to determine a lumped parameter resistance model along the plurality of measurement lines; and
estimating an electrical resistivity value at a selected location on the conductive film encompassed by measurement lines extending between at least three of the plurality of probe locations.

18. The method of claim 17, wherein the applying is effected by at least one of adhering, forming, spraying, thermally spraying, chemical vapor deposition, plasma enhanced chemical vapor deposition or atomic layer deposition.

19. The method of claim 17, further comprising extrapolating the electrical resistivity value at the selected location to another physical property correlative with the electrical resistivity value.

20. The method of claim 19, wherein the another physical property is selected from the group consisting of a thermal property, strain, photosensitivity, and physical anomalies.

21. The method of claim 17, further comprising initiating the measuring, analyzing and estimating in response to an event.

22. The method of claim 17, further comprising repeating the estimating for a plurality of selected locations to develop a resistivity profile across the conductive film.

23. The method of claim 22, further comprising extrapolating the resistivity profile to a profile of another physical property correlative with the resistivity profile.

24. The method of claim 23, wherein the another physical property is selected from the group consisting of a thermal property, strain, photosensitivity, and physical anomalies.

25. The method of claim 17, further comprising repeating the measuring, analyzing, and estimating for a plurality of selected locations and at a plurality of times to develop a time varying resistivity profile across the conductive film.

26. The method of claim 25, further comprising extrapolating the time varying resistivity profile to a time varying profile of another physical property correlative with the time varying resistivity profile.

27. The method of claim 26, wherein the another physical property is selected from the group consisting of a thermal property, strain, photosensitivity, and physical anomalies.

28. The method of claim 17, wherein the estimating further comprises performing a weighted average of the lumped parameter resistance model associated with each of three measurement lines defining a triangle encompassing the selected location to determine the electrical resistivity value, wherein the weighted average is related to orthogonal distances from the selected location to each of the three measurement lines defining the triangle.

29. The method of claim 17, wherein the estimating further comprises:

performing a weighted average of the lumped parameter resistance model associated with each of three measurement lines defining a triangle encompassing the selected location to determine a first electrical resistivity value, wherein the weighted average is related to orthogonal distances from the selected location to each of the three measurement lines defining the triangle;

performing a at least one additional weighted average of the lumped parameter resistance model associated with each of three other measurement lines, at least two of which are different than measurement lines of the three measurement lines, defining an additional triangle encompassing the selected location to determine at least one additional electrical resistivity value, wherein the weighted average is related to orthogonal distances from the selected location to each of the three other measurement lines defining the additional triangle; and

combining the first electrical resistivity value and the at least one additional electrical resistivity value to determine the electrical resistivity value.

30. The method of claim 17, further comprising removing at least one measured electrical resistance from consideration in the analyzing.

31. The method of claim 30, further comprising estimating when the at least one measured electrical resistance to be removed is anomalous.

32. The method of claim 17, wherein the surface of the structure comprises a nonplanar surface in three dimensions.

33. A method for determining surface properties of a structure bearing an electrically conductive film over a surface of the structure, comprising:

selecting a plurality of probe locations proximate a periphery of the conductive film;

measuring electrical resistance along a plurality of measurement lines, the plurality of measurement lines comprising line segments extending between each probe location and at least some other probe locations in the plurality of probe locations;

analyzing the measured electrical resistances to determine a lumped parameter resistance model along the plurality of measurement lines; and

estimating an electrical resistivity value at a selected location on the conductive film encompassed by measurement lines extending between at least three of the plurality of probe locations.

34. The method of claim 33, further comprising extrapolating the electrical resistivity value at the selected location to another physical property correlative with the electrical resistivity value.

35. The method of claim 34, wherein the another physical property is selected from the group consisting of a thermal property, strain, photosensitivity, and physical anomalies.

36. The method of claim 33, further comprising initiating the measuring, analyzing and estimating in response to an event.

37. The method of claim 33, further comprising repeating the estimating for a plurality of selected locations to develop a resistivity profile across the conductive film.

38. The method of claim 37, further comprising extrapolating the resistivity profile to a profile of another physical property correlative with the resistivity profile.

39. The method of claim 38, wherein the another physical property is selected from the group consisting of a thermal property, strain, photosensitivity, and physical anomalies.

40. The method of claim 33, further comprising repeating the measuring, analyzing, and estimating for a plurality of selected locations and at a plurality of times to develop a time varying resistivity profile across the conductive film.

41. The method of claim 40, further comprising extrapolating the time varying resistivity profile to a time varying profile of another physical property correlative with the time varying resistivity profile.

42. The method of claim 41, wherein the another physical property is selected from the group consisting of a thermal property, strain, photosensitivity, and physical anomalies.

43. The method of claim 33, wherein the estimating further comprises performing a weighted average of the lumped parameter resistance model associated with each of three measurement lines defining a triangle encompassing the selected location to determine the electrical resistivity value, wherein the weighted average is related to orthogonal distances from the selected location to each of the three measurement lines defining the triangle.

44. The method of claim 33, wherein the estimating further comprises:

performing a weighted average of the lumped parameter resistance model associated with each of three measurement lines defining a triangle encompassing the selected location to determine a first electrical resistivity value, wherein the weighted average is related to orthogonal distances from the selected location to each of the three measurement lines defining the triangle;

performing a at least one additional weighted average of the lumped parameter resistance model associated with each of three other measurement lines, at least two of which are different than measurement lines of the three measurement lines, defining an additional triangle encompassing the selected location to determine at least one additional electrical resistivity value, wherein the weighted average is related to orthogonal distances from the selected location to each of the three other measurement lines defining the additional triangle; and

combining the first electrical resistivity value and the at least one additional electrical resistivity value to determine the electrical resistivity value.

45. The method of claim 33, further comprising removing at least one measured electrical resistance from consideration in the analyzing.

46. The method of claim 45, further comprising estimating when the at least one measured electrical resistance to be removed is anomalous.

47. The method of claim 33, wherein the surface of the structure comprises a nonplanar surface in three dimensions.

48. A system configured for determining surface properties of a structure bearing an electrically conductive film over a surface thereof, comprising:

a plurality of probes adapted for measuring an electrical resistance when placed at a plurality of probe locations proximate a periphery of the conductive film;

a signal controller operably coupled to each of the plurality of probes and configured for selecting at least one pair of probes of the plurality of probes at any given time;

a signal sampler operably coupled to the signal controller and configured for sampling the electrical resistance between probes of the selected at least one pair of probes; and

a processor operably coupled to the signal sampler and configured for:

analyzing a plurality of sampled electrical resistances to determine a lumped parameter resistance model; and

estimating an electrical resistivity value at a selected location on the conductive film encompassed by at measurement lines extending between least three of the plurality of probe locations.

49. The system of claim 48, wherein the processor is further configured for extrapolating the electrical resistivity value at the selected location to another physical property correlative with the electrical resistivity value.

50. The system of claim 49, wherein the another physical property is selected from the group consisting of a thermal property, strain, photosensitivity, and physical anomalies.

51. The system of claim 48, wherein the processor is further configured for initiating the measuring, analyzing and estimating in response to an event.

52. The system of claim 48, wherein the processor is further configured for repeating the estimating for a plurality of selected locations to develop a resistivity profile across the conductive film.

53. The system of claim 52, wherein the processor is further configured for extrapolating the resistivity profile to a profile of another physical property correlative with the resistivity profile.

54. The system of claim 53, wherein the another physical property is selected from the group consisting of a thermal property, strain, photosensitivity, and physical anomalies.

55. The system of claim 48, wherein the processor is further configured for repeating the measuring, analyzing, and estimating for a plurality of selected locations and at a plurality of times to develop a time varying resistivity profile across the conductive film.

56. The system of claim 55, wherein the processor is further configured for extrapolating the time varying resistivity profile to a time varying profile of another physical property correlative with the time varying resistivity profile.

57. The system of claim 56, wherein the another physical property is selected from the group consisting of a thermal property, strain, photosensitivity, and physical anomalies.

58. The system of claim 48, wherein the estimating further comprises performing a weighted average of the lumped parameter resistance model associated with each of three measurement lines defining a triangle encompassing the selected location to determine the electrical resistivity value, wherein the weighted average is related to orthogonal distances from the selected location to each of the three measurement lines defining the triangle.

59. The system of claim 48, wherein the estimating further comprises:

performing a weighted average of the lumped parameter resistance model associated with each of three measurement lines defining a triangle encompassing the selected location to determine a first electrical resistivity value, wherein the weighted average is related to orthogonal distances from the selected location to each of the three measurement lines defining the triangle;

performing a at least one additional weighted average of the lumped parameter resistance model associated with each of three other measurement lines, at least two of which are different than measurement lines of the three measurement lines, defining an additional triangle encompassing the selected location to determine at least one additional electrical resistivity value, wherein the weighted average is related to orthogonal distances from the selected location to each of the three other measurement lines defining the additional triangle; and

combining the first electrical resistivity value and the at least one additional electrical resistivity value to determine the electrical resistivity value.

60. The system of claim 48, wherein the processor is further configured for removing at least one measured electrical resistance from consideration in the analyzing.

61. The system of claim 60, wherein the processor is further configured for estimating when the at least one measured electrical resistance to be removed is anomalous.

62. The system of claim 48, wherein the surface of the structure comprises a nonplanar surface in three dimensions.